Objective: To determine the temperature coefficient of resistance for platinum, using a platinum resistance thermometer and a callender and Griffith's bridge.

Apparatus: Callender and Griffith's bridge, platinum resistance thermometer, galvanometer, hot water bath, battery plug key, rheostat and connection wires.

Working Formula:

Temperature coefficient of resistance, $\alpha$, is given by

$$\alpha = \frac{R_2 - R_1}{R_1 \frac{t_2 - t_1}{t_2}} \quad \text{per } ^\circ C$$

where,

$R_1 = \text{Resistance of platinum wire at } t_1$.

$R_2 = \text{Resistance of platinum wire at } t_2$.  

Teacher's Signature:  


### 1)

<table>
<thead>
<tr>
<th>S. No</th>
<th>Position of beam point when both FP and CC of PRT</th>
<th>Electrical zero (cm)</th>
<th>Mean electrical zero in cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>21.5</td>
<td>0</td>
<td>21.76</td>
</tr>
<tr>
<td>2.</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>21.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2)

<table>
<thead>
<tr>
<th>S. No</th>
<th>Resistance intro. in moving coil resistance</th>
<th>Distance of null point on bridge wire</th>
<th>Distance between E 1 and null point</th>
<th>$\frac{R_1}{2R}$</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1</td>
<td>0</td>
<td>-21.76</td>
<td>0.6229</td>
<td>0.6229</td>
</tr>
</tbody>
</table>
Using a Callender and Griffith's bridge, the resistance \( R \) is,

\[ R = \Delta R \pm 2 \Delta \rho \]

\( \Delta R \) = Resistance per unit length of the Callender bridge potentiometer wire.

\( \Delta \rho \) = Resistance introduced in resistance box.

\( \Delta L \) = Distance of null point from middle point (electrical zero).

The proper sign is used according as the balance point lies to the right or left of the electric zero.

**DIAGRAM:**

Platinum Resistance Thermometer

2. The resistance of an electric conductor is a function of temp. and forms the basis of resistance thermometer. Many of conductors do not offer the same resistance at a given temp. always but the resistance of a platinum wire free from impurities is found to be a unique function.
<table>
<thead>
<tr>
<th>S.No</th>
<th>Temp. of both (°C)</th>
<th>Resistance (Ω) used in coil</th>
<th>Reading (°C)</th>
<th>Shift of balance from electrical zero</th>
<th>Resistance of platinum wire in the thermometer (Ω)</th>
<th>Mean (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Room temp. = 30°C</td>
<td>3°C</td>
<td>26.5</td>
<td>4.74</td>
<td>3.209</td>
<td>3.55</td>
</tr>
<tr>
<td></td>
<td>Temp. of boiling water</td>
<td>3°C</td>
<td>34.2</td>
<td>12.44</td>
<td>3.91</td>
<td></td>
</tr>
</tbody>
</table>

**Calculation:**

\[
\alpha = \frac{R_2 - R_1}{R_1T_2 - R_2T_1}
\]

\[
= \frac{0.701}{3.209 \times 95 + 3.91 \times 36}
\]

\[
= \frac{0.701}{422} = 0.00166 \text{ per } °C
\]

\[
= 16 \times 10^{-4} \text{ per } °C
\]
of temperature. A platinum wire free from impurities double on itself to avoid induction effect, is wound on a thin plate of mica. The ends of the platinum wire are soldered to two thick leads of copper or platinum whose other ends are connected to two terminals if on the top of porcelain tube. Parallel to thick leads there are two extra identical leads whose other ends are connected to the terminals of. This extra pair of leads is called compensating leads. The function of compensating leads is to eliminate the resistance of the connecting leads to platinum wire at all temperatures. A no. of mica discs are placed in the tube to insulate the leads from each other. This also prevents convection current in the air of the tube.

# Observations: See LHS

# Calculations:

Temperature coefficient

\[ \alpha = \frac{R_2 - R_1}{R_{1t_2} - R_{2t_1}} \]

\[ \alpha = 16 \times 10^{-4} \text{ per } ^\circ \text{C.} \]

Teacher’s Signature:
# Result:

The temperature coefficient of resistance for platinum = $16 \times 10^{-4}$ per °C.

The standard value of temperature coefficient of resistance for platinum = $37 \times 10^{-4}$ per °C.

# Percentage error:

$$\frac{\text{Standard value} - \text{Experimental value}}{\text{Standard value}} \times 100\%$$

$$= \frac{37 \times 10^{-4} - 16 \times 10^{-4}}{37} \times 100\%$$

$$\Rightarrow 5.6\%$$

# Precautions:

1) Jockey should be pressed on the bridge wire so as to make proper contact.

2) The jockey should never be kept pressed while it is being moved on the wire.